

299-E24-60 (A5917) Log Data Report

Borehole Information:

Borehole: 299-E24-60 (A5917)		Site: 216-A-10 Crib			
Coordinates (WA State Plane)		GWL(ft)¹: Not deep enough		GWL Date: 2/24/2003	
North	East	Drill Date	TOC² Elevation	Total Depth (ft)	Type
135,435.78 m	574,964.09 m	June 1956	220.135 m	200	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	2.25	6 5/8	6	0.3125	+2.25	200
The logging engineer measured the casing stick up using a steel tape. A caliper was used to determine the outside casing diameter. The caliper and inside casing diameter were measured using a steel tape. Measurements were rounded to the nearest 1/16 in. Casing thickness was calculated. There is no evidence of 8-in. casing at the ground surface as reported in Chamness and Merz (1993). Surrounding the borehole stick-up is a round 24-in. by 4-in. high surface seal of grout.						

Borehole Notes:

Borehole coordinates, elevation, and well construction information are from measurements by Stoller field personnel, HWIS³, and Chamness and Merz (1993). Zero reference is the top of the 6-in. casing. A reference point survey "X" is located at the top of the casing stickup.

Logging Equipment Information:

Logging System:	Gamma 3E (RLS-1)	Type:	70% HPGe
Calibration Date:	10/2002	Calibration Reference:	GJO-2002-386-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3/Repeat	4	
Date	2/25/03	2/27/03	3/03/03	3/03/03	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth (ft)	196.0	136.0	46.0	25.0	
Finish Depth (ft)	135.0	26.0	26.0	3.0	
Count Time (sec)	150	150	150	150	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	1.0	
ft/min	N/A ⁴	N/A	N/A	N/A	
Pre-Verification	CE131CAB	CE151CAB	CE161CAB	CE161CAB	

Log Run	1	2	3/Repeat	4	
Start File	CE141000	CE151000	CE161000	CE161021	
Finish File	CE141061	CE151110	CE161020	CA161043	
Post-Verification	CE141CAA	CE151CAA	CE161CAA	CE161CAA	
Depth Return Error (in.)	+1	0	N/A	0	
Comments	Fine-gain adjustment after files -001, -002, -008, and -018.	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	

Logging Operation Notes:

Zero reference was top of the 6-in. casing. Logging was performed without the centralizer on the sonde. The count time of 150 sec was used because of the possible presence of double casing and grout. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K , ^{238}U , and ^{232}Th) verifier with serial number 118. During SGLS logging, fine-gain adjustments were needed to maintain the 1460-keV (^{40}K) photopeak at a pre-described channel.

Analysis Notes:

Analyst:	Sobczyk	Date:	03/11/03	Reference:	GJO-HGLP 1.6.3, Rev. 0
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SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The post-run verification spectra were all within the control limits established on 12/05/2002. Pre-run verification spectrum CE131CAB was slightly above the value for the 1461 peak counts per second. The peak counts per second at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 3 percent lower and 2 percent higher at the end of the day. Examinations of spectra indicate that the detector functioned normally during all of the logging runs, and the spectra are accepted.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G3Eoct02.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 6-in. casing. The casing configuration was assumed to be one string of 6-in. casing to the maximum depth of the logging (196 ft). The casing correction factor was calculated assuming a casing thickness of 0.3125 in. This casing thickness is based upon the field measurement. A water correction was not needed or applied to the data. Dead time corrections were applied when dead time was greater than 18 percent.

Chamness and Merz (1993) suggest that this borehole may also contain an 8-in. casing to at least 144 ft. If this is correct, then radionuclide concentrations above this depth may be underestimated.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K , ^{238}U , and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. In addition, comparison log plots of man-made radionuclides are provided to compare the data collected in 1995 by Westinghouse Hanford Company's Radionuclide Logging System (RLS) with SGLS data. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated

with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs and ^{154}Eu were the man-made radionuclides detected in this borehole. ^{137}Cs was detected in two intervals. ^{137}Cs was detected at log depths between 53 and 85 ft. The range of concentrations was from 2.7 pCi/g to 530 pCi/g; the maximum concentration was measured at 62 ft. ^{137}Cs was detected at log depths between 147 and 179 ft. The range of concentrations was from near the MDL (0.2 pCi/g) to 0.6 pCi/g, which was measured at 161 ft. ^{154}Eu was detected in two intervals. ^{154}Eu was detected in the interval between 66 and 76 ft. The range of concentrations was from 0.4 pCi/g to 1.0 pCi/g; the maximum concentration was measured at 71 ft. ^{154}Eu was detected between 87 and 92 ft. The range of concentrations was from 0.3 pCi/g to 1.5 pCi/g, which was measured at 88 ft. ^{154}Eu was also detected near the MDL (0.2 pCi/g) at 81 ft.

Chamness and Merz (1993) reported that the hole was deepened in July 1982 to a total depth of 200 ft and a 6-in. liner was installed and grouted. The total gamma increases by 50 cps and ^{40}K increases by 5 pCi/g at 153 ft. Above 153 ft, the ^{40}K values range between 5 and 15 pCi/g. These values are relatively low when compared to nearby single cased holes. Therefore, the concentrations of the KUT and man-made radionuclides above 153 ft may be slightly under estimated.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides (609, 1461, 1764, and 2614 keV).

Gross gamma logs from Additon et al. (1977) (attached) indicate that the sediments surrounding this borehole contained significant amounts of man-made gamma radiation from 1963 through at least 1976. The log from 5/13/59 appears to detect background levels of gamma radiation. The log from 4/26/63 appears to detect relatively high gamma activity in the interval from 16 ft (5 m) to total depth (150 ft). The log from 4/28/76 appears to detect relatively high gamma activity in the interval from 46 ft (14 m) to 92 ft (28 m). Comparison of these gross gamma logs indicates that a major contamination event occurred between 1959 and 1963 and that the logs go to about 44 m (144 ft), which is close to the total depth before the well was deepened in 1982. The SGLS detected man-made radionuclides from 53 through 92 ft.

Comparison log plots of data collected in 1995 by Westinghouse Hanford Company (WHC) and in 2003 by Stoller are included. The WHC concentration data for ^{137}Cs and ^{154}Eu are decayed to the date of the SGLS logging event in March 2003. The SGLS and RLS logs appear to use a slightly different depth reference. Taking into account the differences in depth registration, the apparent ^{137}Cs concentrations show good agreement between the logging systems. The MDL, for the 1995 data were not reported, and the detection limit for the ^{154}Eu data is unknown because photopeaks at multiple energy levels (123, 723, 873, 1004, and 1274 keV) were used to determine ^{154}Eu concentrations. Thus, a valid comparison of the 2003 data, which is based solely on the 1274-keV photopeak, with the 1995 data could not be made. Since 1995, ^{137}Cs activities have decreased as predicted by radioactive decay.

References:

Chamness, M.A., and J.K. Merz, 1993. *Hanford Wells*, PNL-8800, Pacific Northwest Laboratory, Richland, Washington.

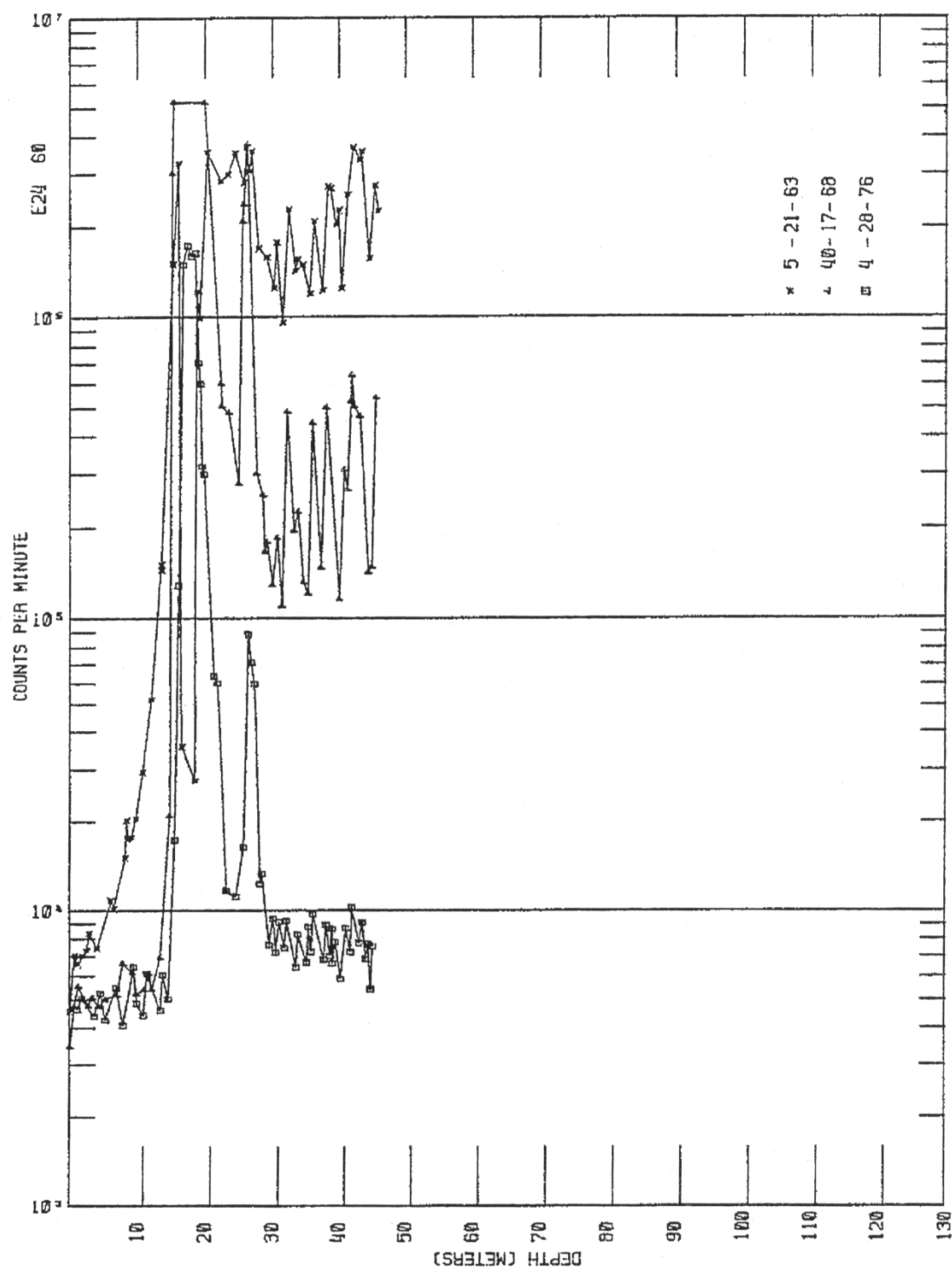
Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Wells*, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

¹ GWL – groundwater level

² TOC – top of casing

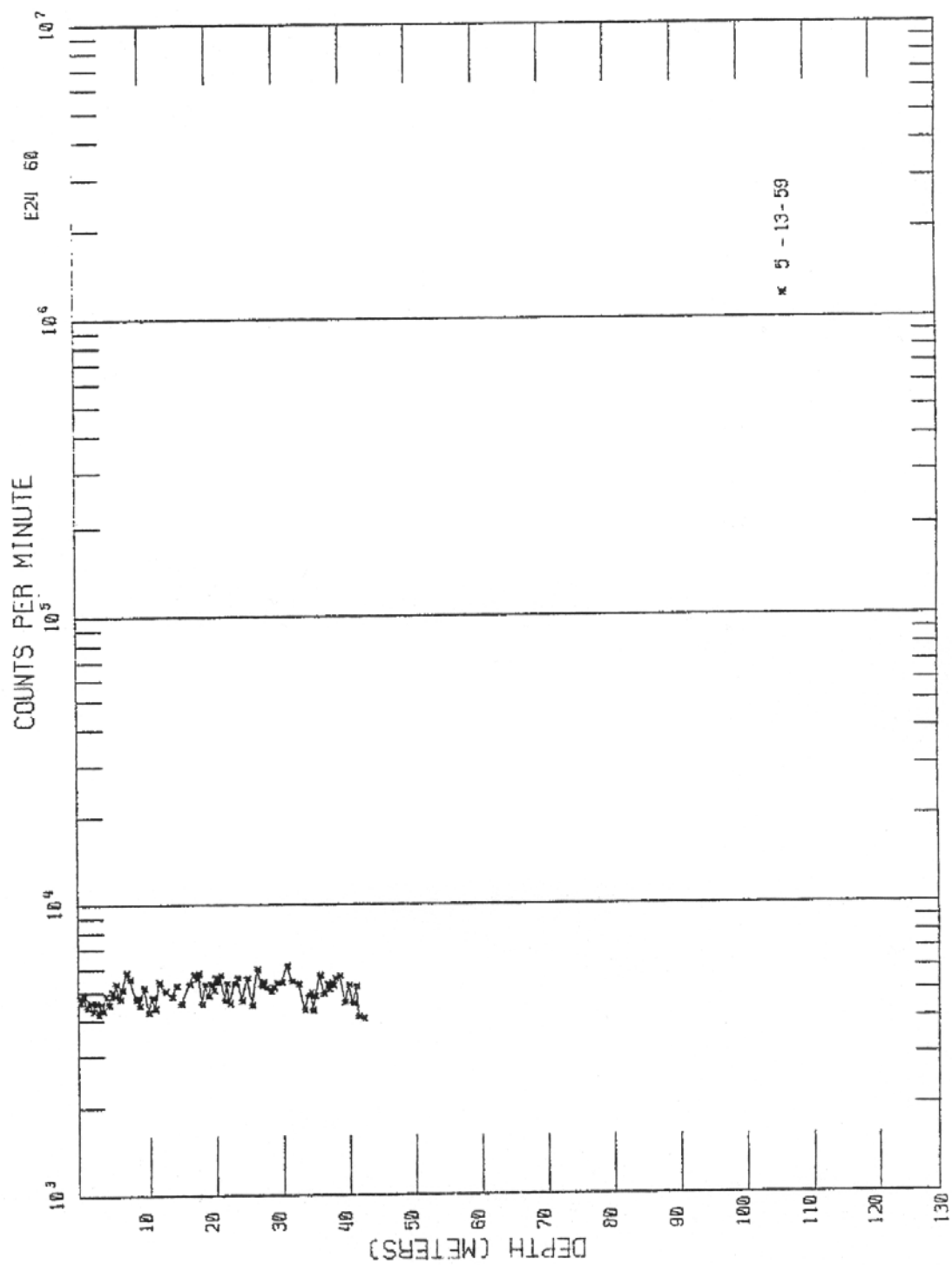
³ HWIS – Hanford Well Information System

⁴ N/A – not applicable



from Additon et al. (1978)

Scintillation Probe Profiles for Borehole 299-E24-60, Logged on 5/21/63, 4/17/68, and 4/28/76

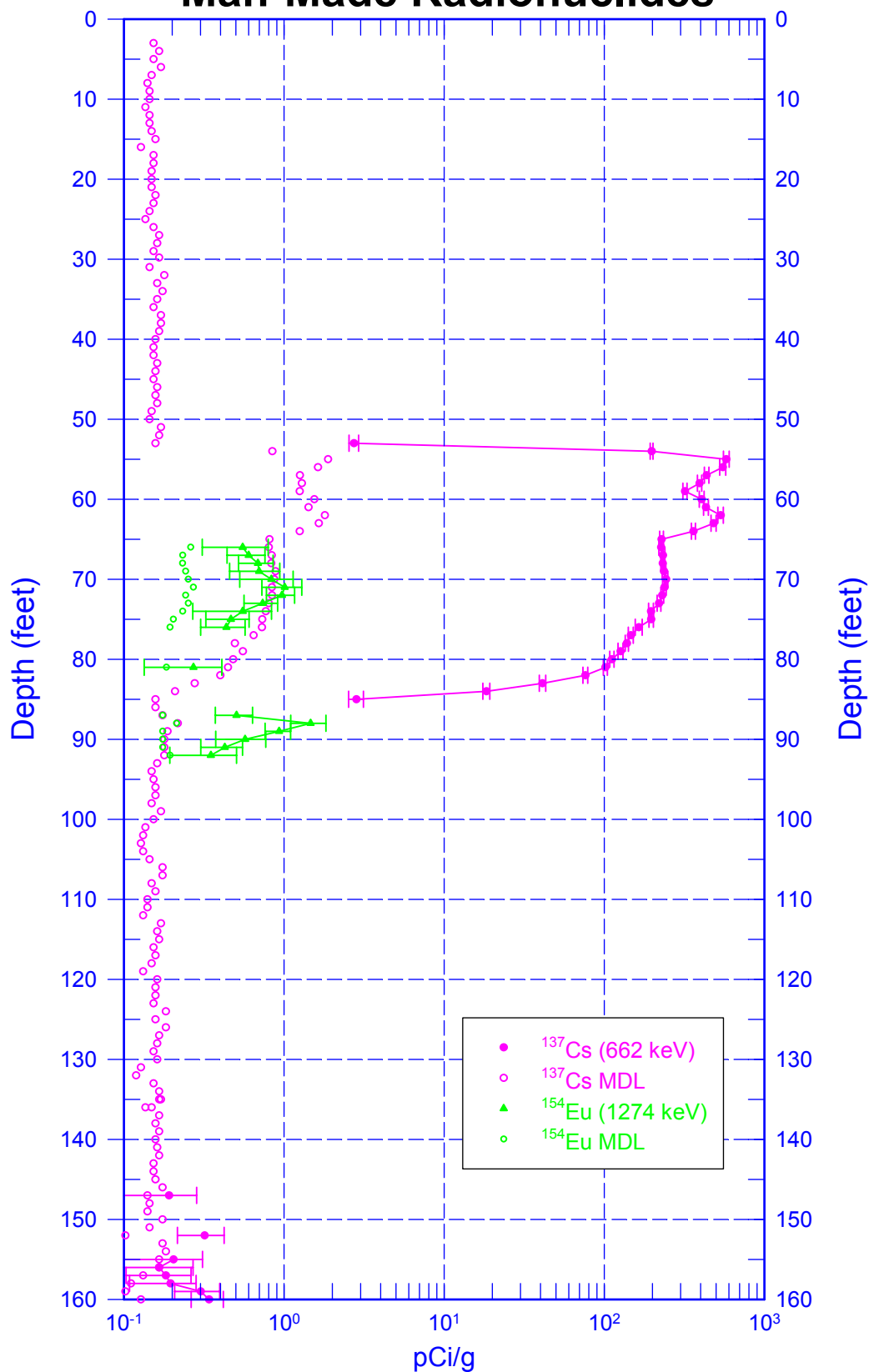


from Additon et al. (1978)

Scintillation Probe Profiles for Borehole 299-E24-59, Logged on 5/13/59

299-E24-60 (A5917)

Man-Made Radionuclides

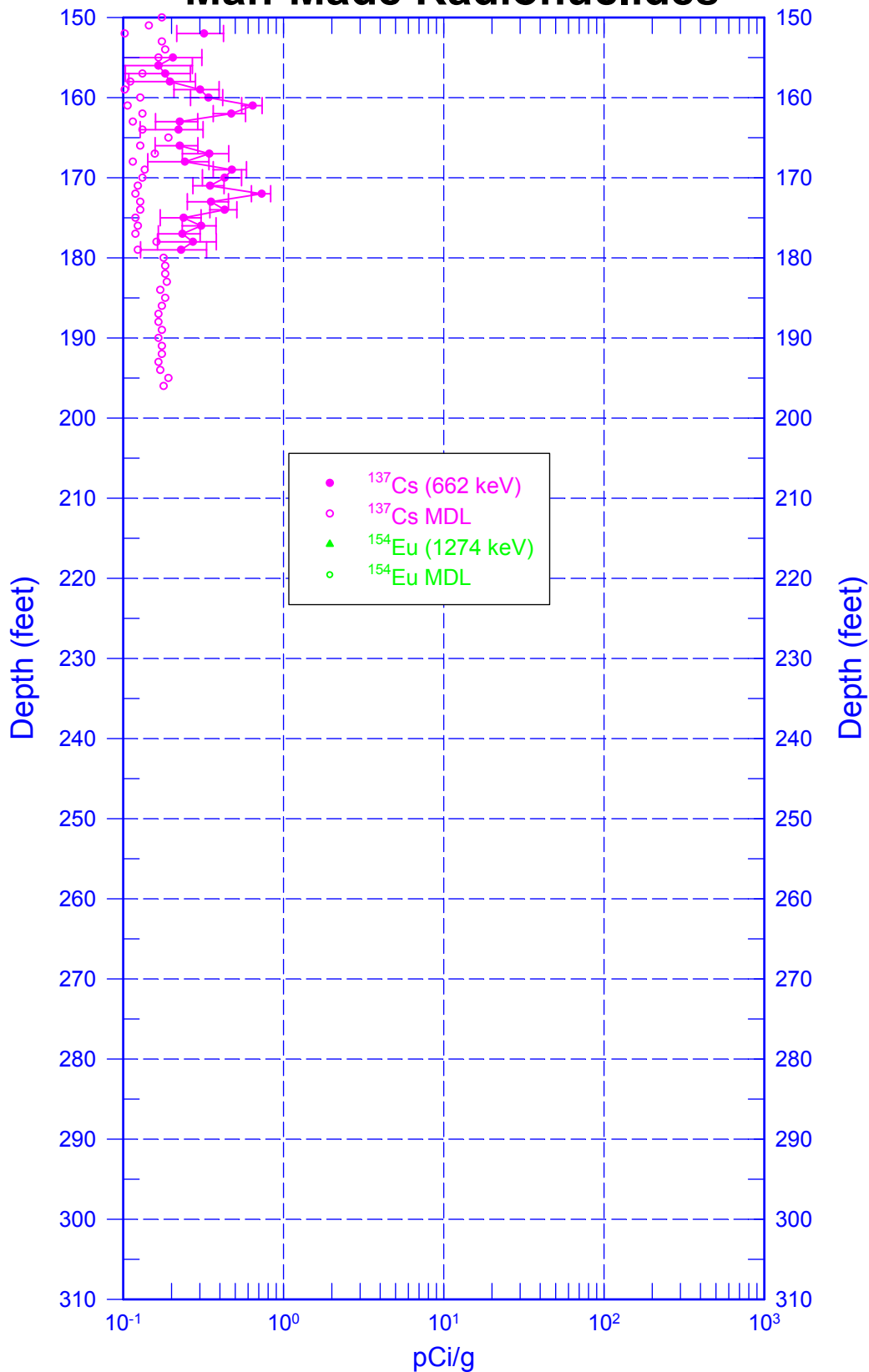


Zero Reference = Top of Casing

Date of Last Logging Run
3/03/2003

299-E24-60 (A5917)

Man-Made Radionuclides

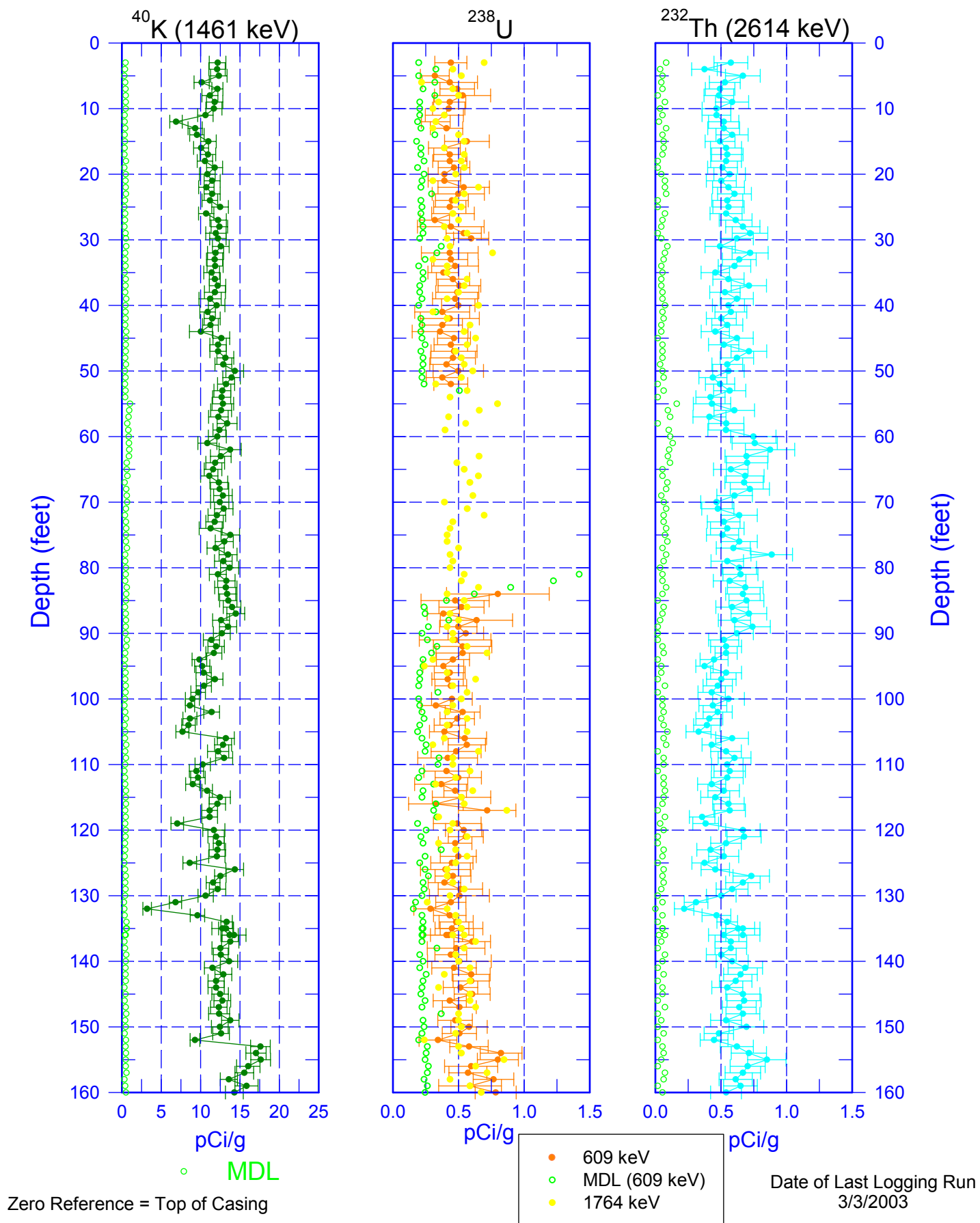


Zero Reference = Top of Casing

Date of Last Logging Run
3/03/2003

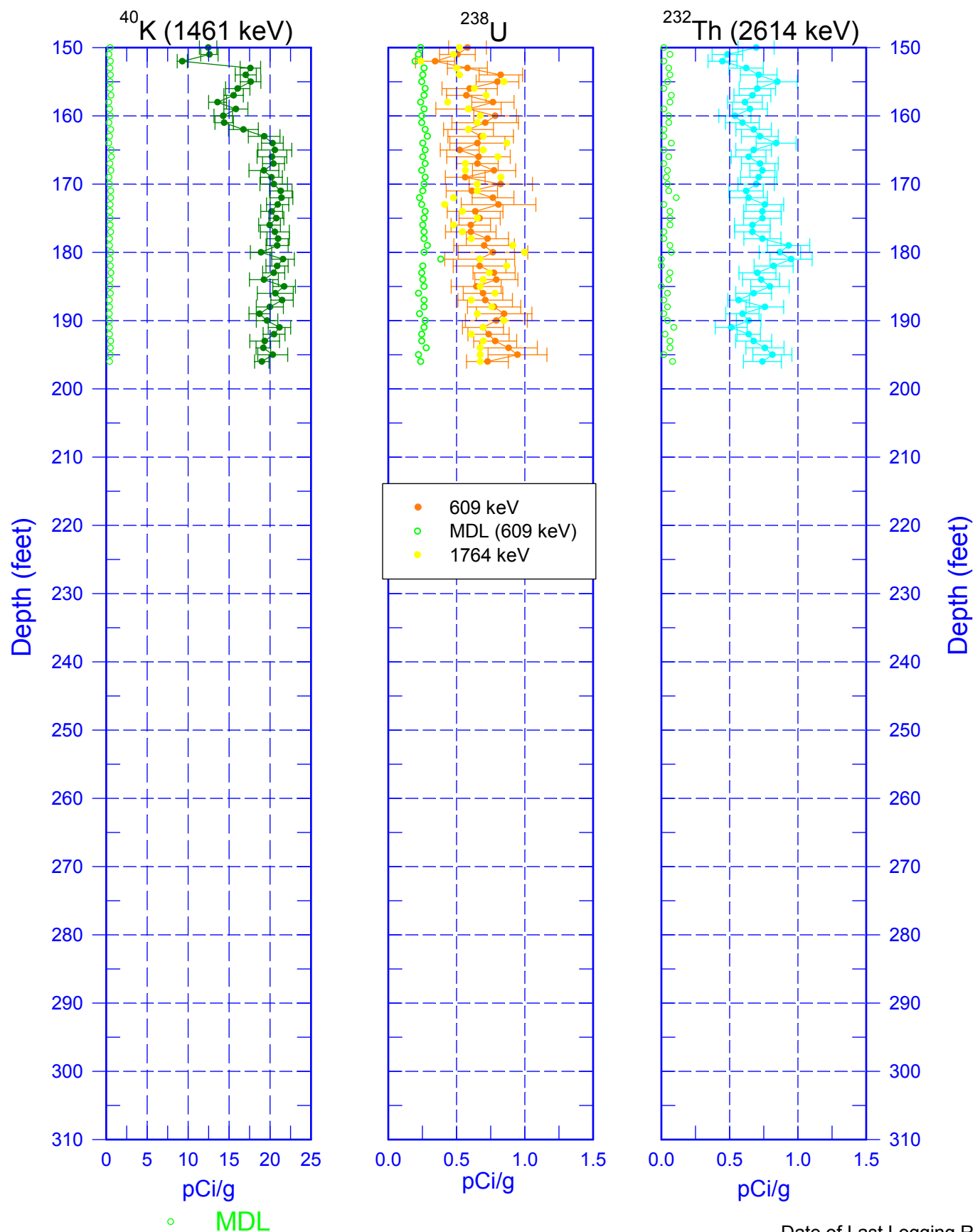
299-E24-60 (A5917)

Natural Gamma Logs



299-E24-60 (A5917)

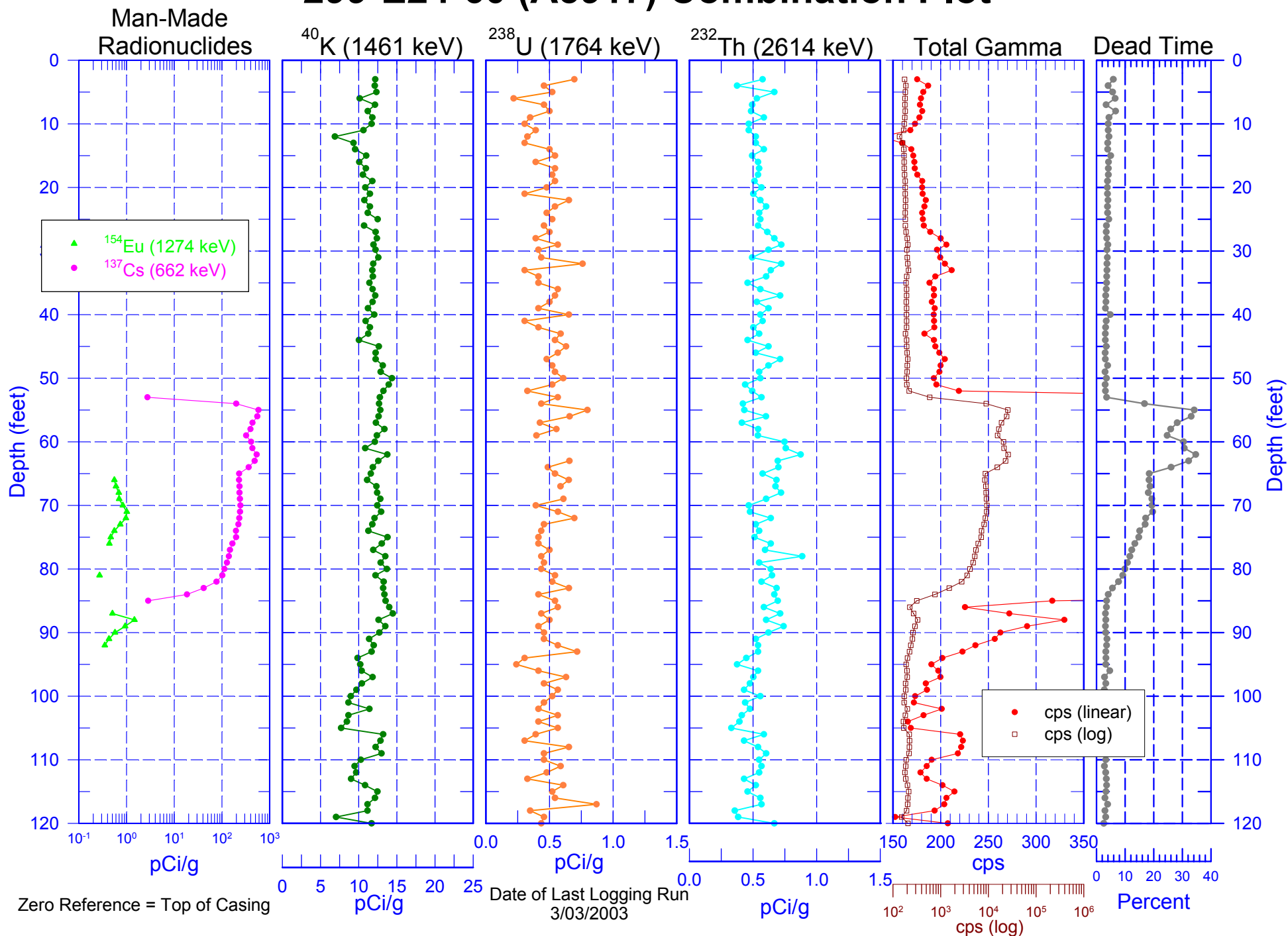
Natural Gamma Logs



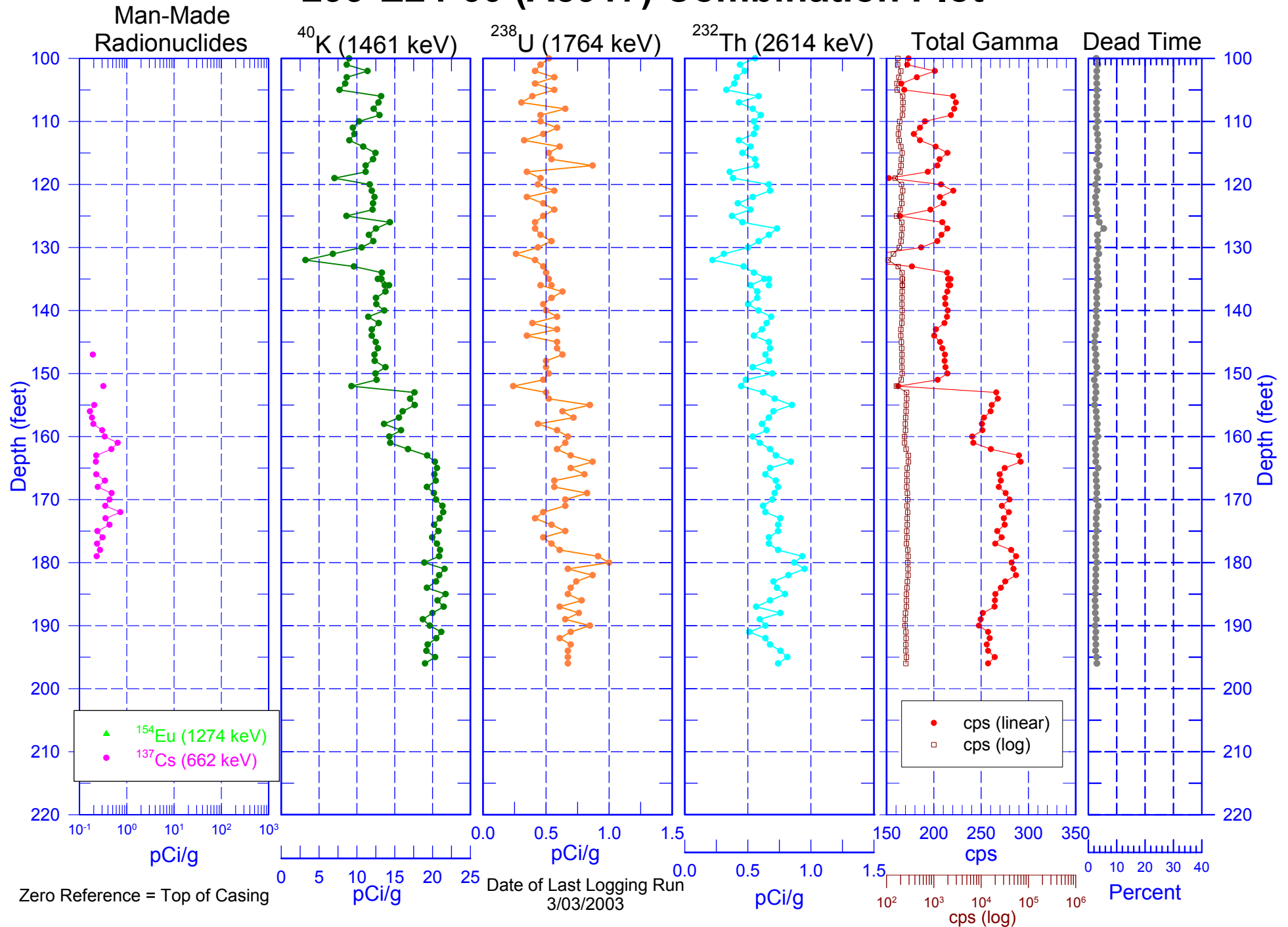
Zero Reference = Top of Casing

Date of Last Logging Run
3/3/2003

299-E24-60 (A5917) Combination Plot

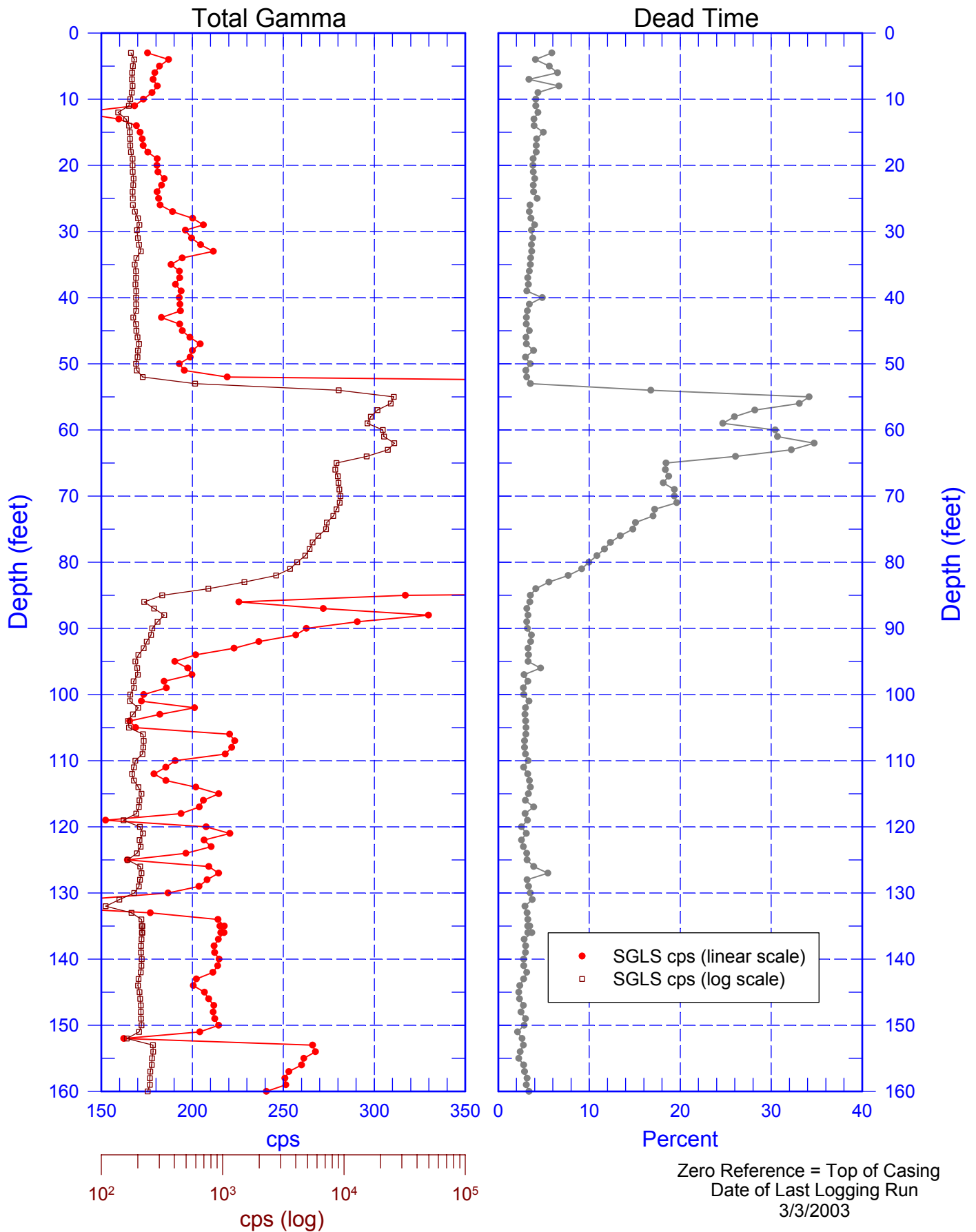


299-E24-60 (A5917) Combination Plot



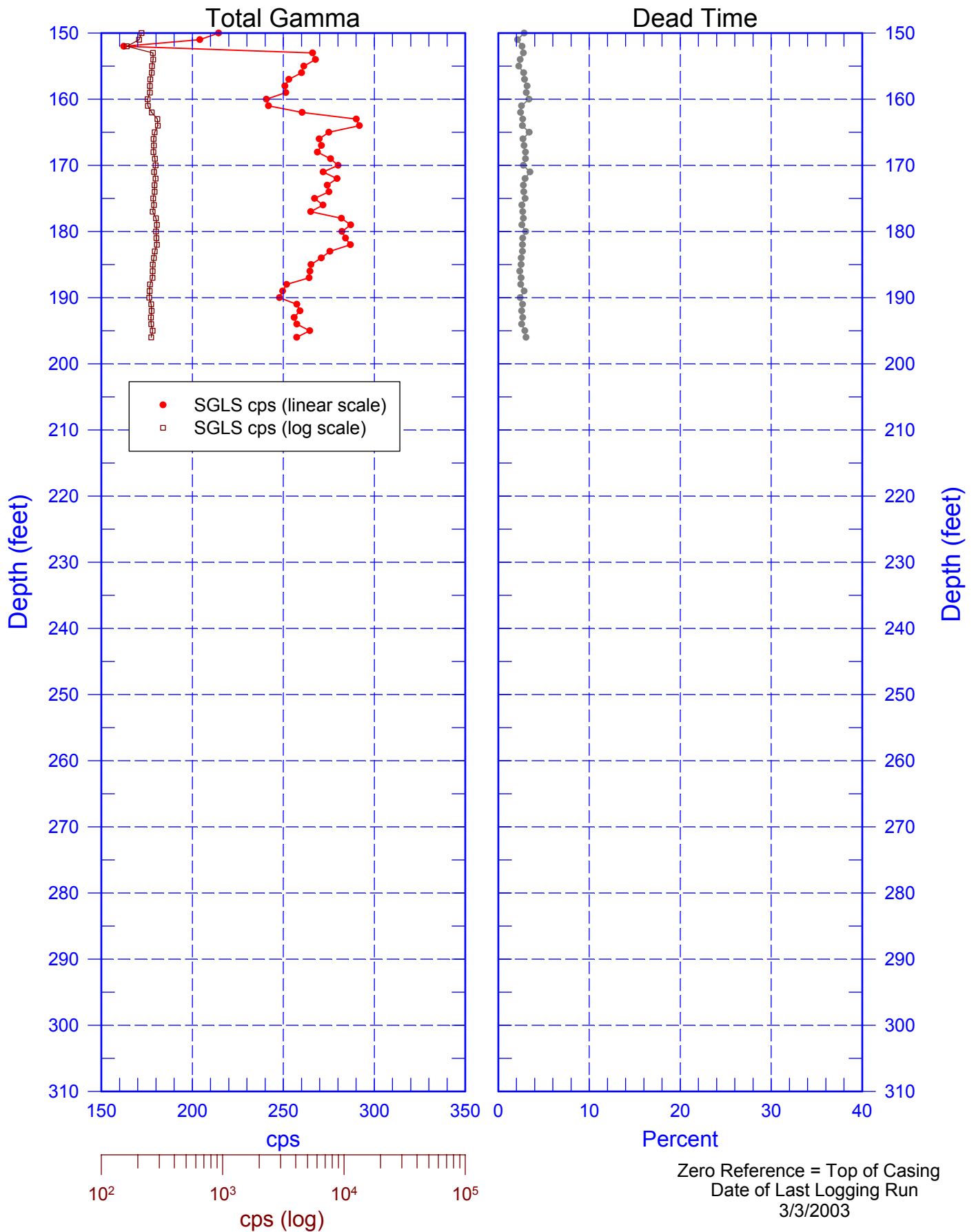
299-E24-60 (A5917)

Total Gamma & Dead Time



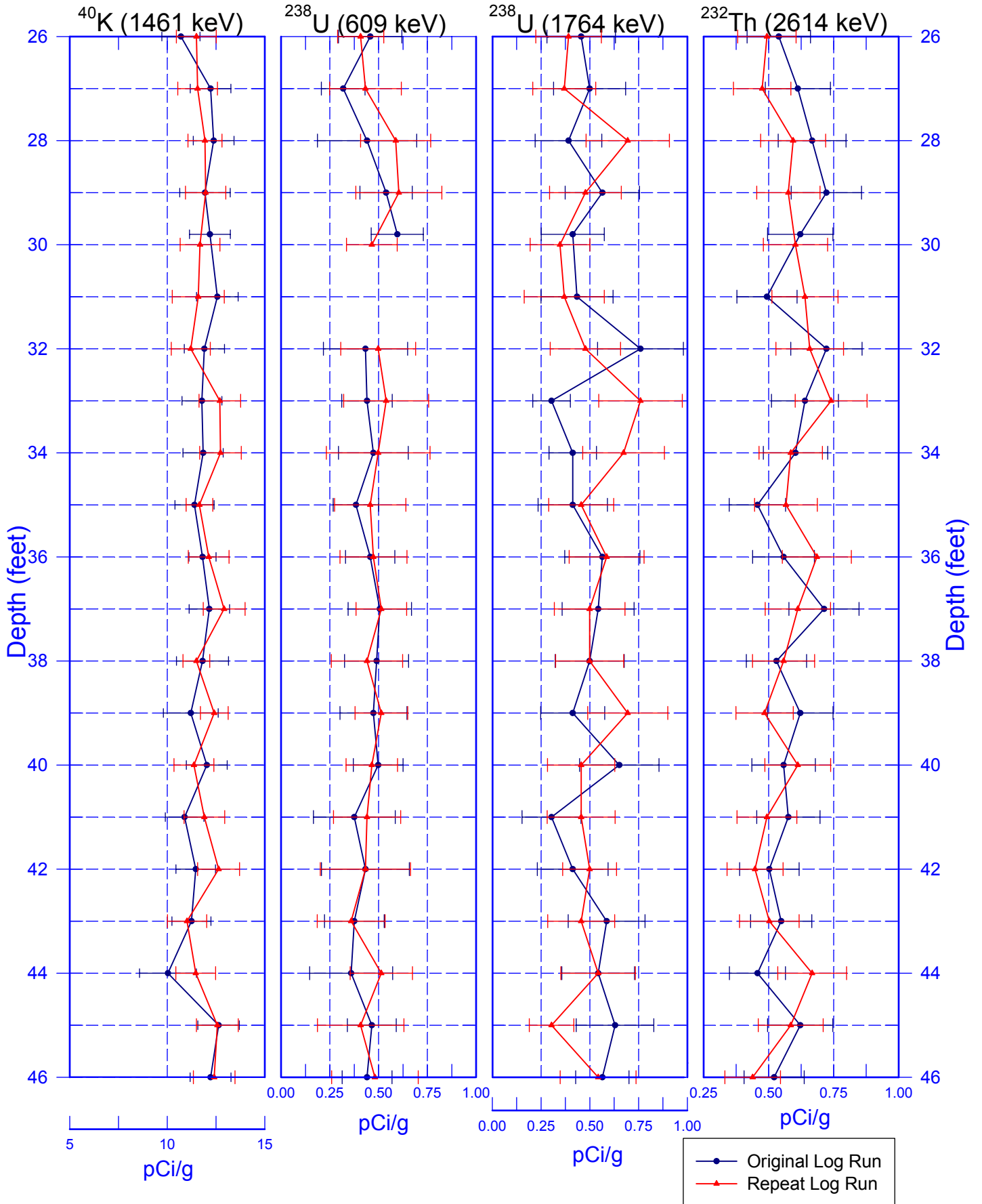
299-E24-60 (A5917)

Total Gamma & Dead Time



299-E24-60 (A5917)

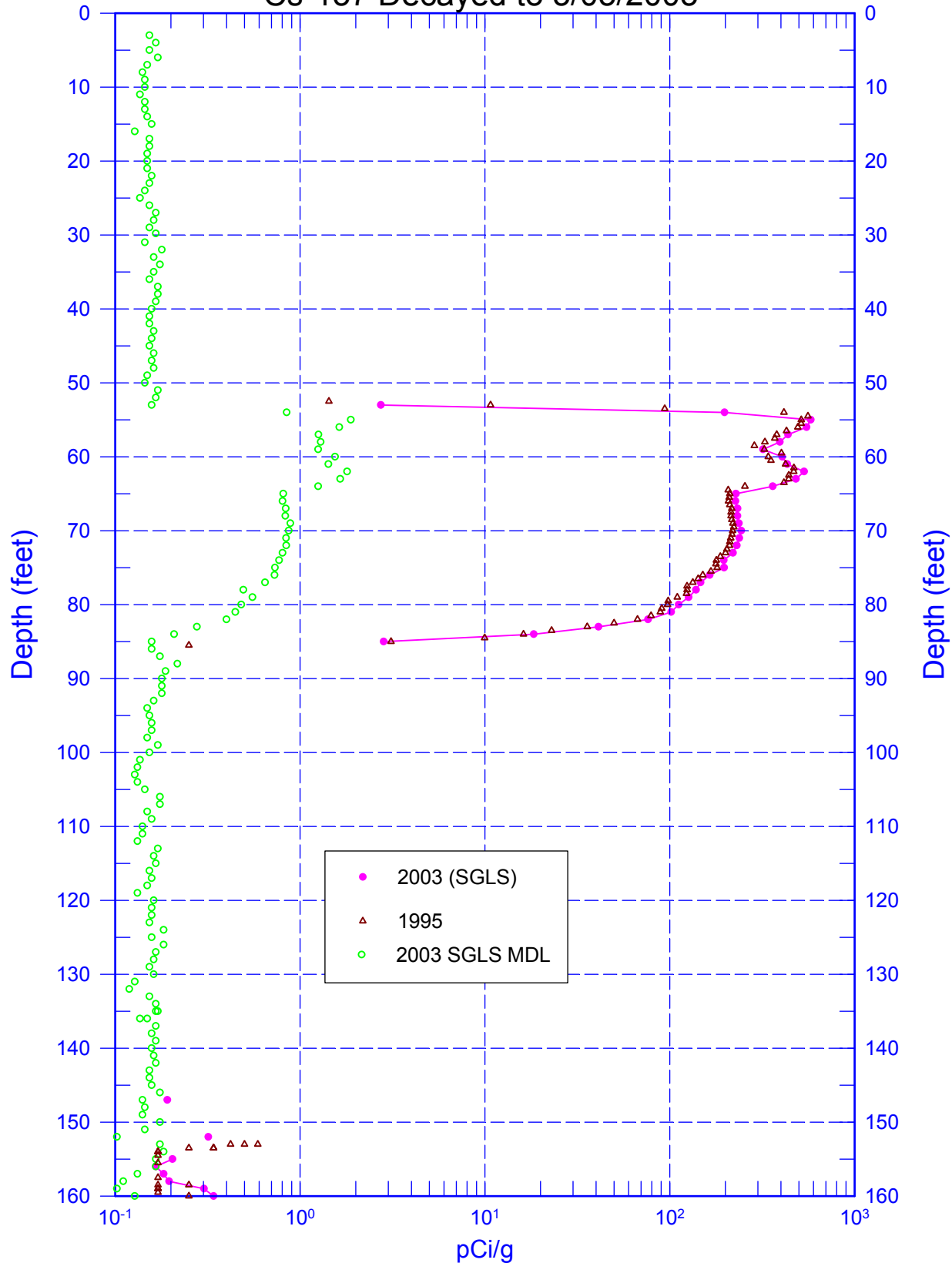
Rerun of Natural Gamma Logs (46.0 to 26.0 ft)



299-E24-60 (A5917)

RLS Data Compared to SGLS Data

Cs-137 Decayed to 3/03/2003

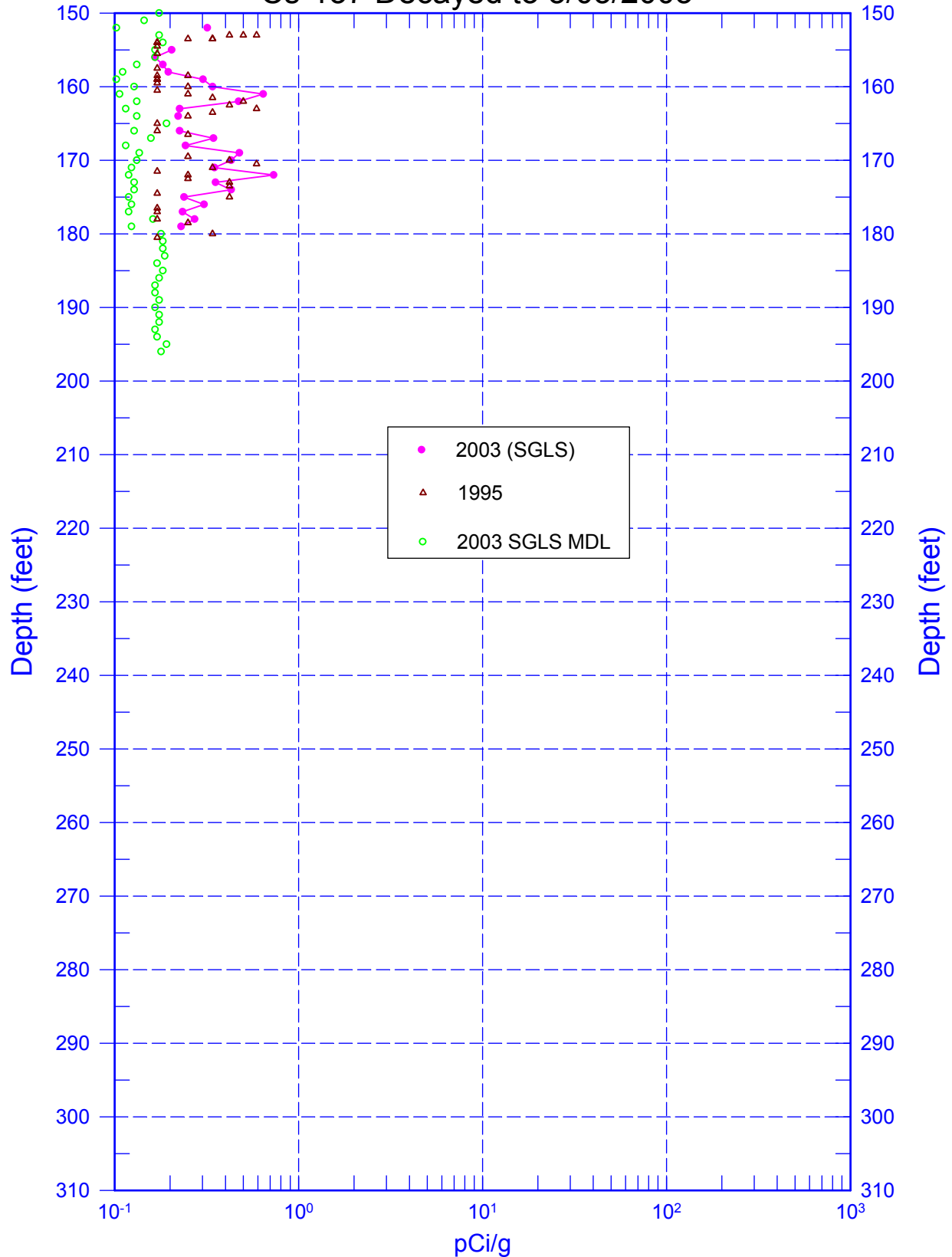


Zero Reference = Top of Casing (2003 SGLS)
1995 RLS shifted -1.0 ft to align with the SGLS

299-E24-60 (A5917)

RLS Data Compared to SGLS Data

Cs-137 Decayed to 3/03/2003

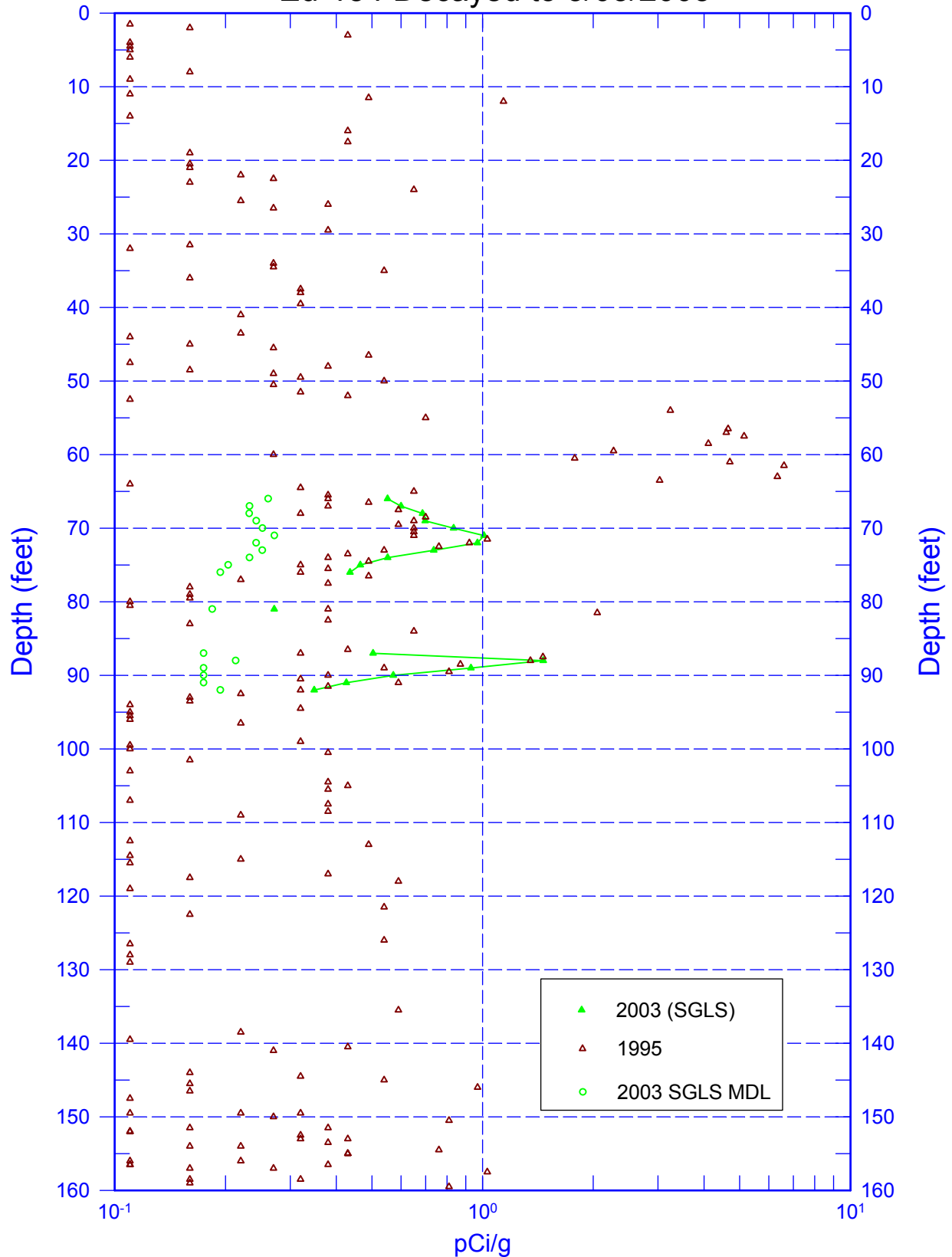


Zero Reference = Top of Casing (2003 SGLS)
1995 RLS shifted -1.0 ft to align with the SGLS

299-E24-60 (A5917)

RLS Data Compared to SGLS Data

Eu-154 Decayed to 3/03/2003

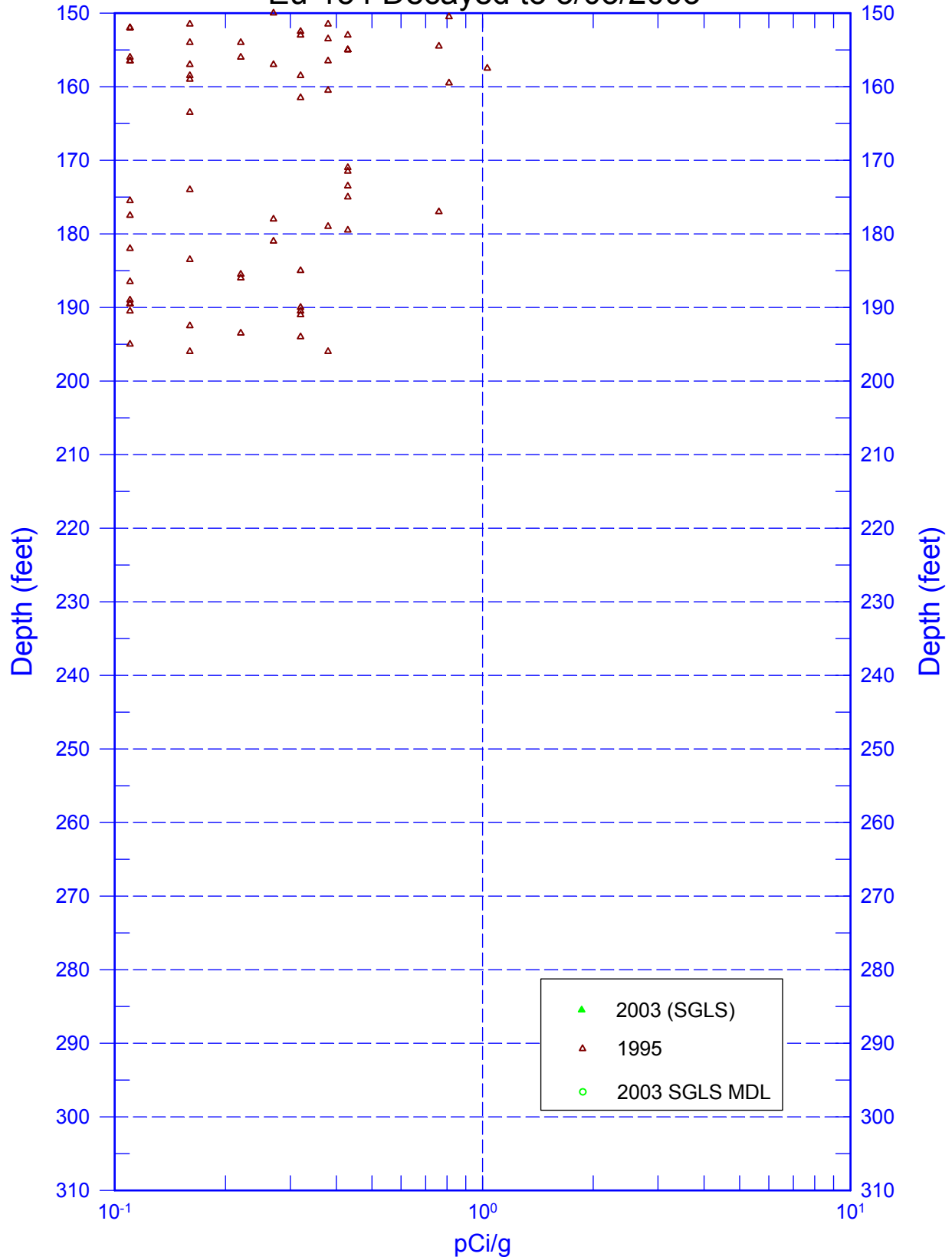


Zero Reference = Top of Casing (2003 SGLS)
1995 RLS shifted -1.0 ft to align with the SGLS

299-E24-60 (A5917)

RLS Data Compared to SGLS Data

Eu-154 Decayed to 3/03/2003



Zero Reference = Top of Casing (2003 SGLS)
1995 RLS shifted -1.0 ft to align with the SGLS